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A submarine escape procedure applied to clandestine penetration.

A TECHNIQUE FOR COASTAL INFILTRATION

John A. Hurley

The various means of agent infiltration into a target area—overland travel, parachuting from or landing in aircraft, paddling a small boat or kayak, swimming from a submarine—all have their disadvantages. Controls on overland travel usually render it more difficult than entry by air or water. The use of an airplane either for parachuting or for landing, however, is often contraindicated by the likelihood of detection and the difficulty of making an accurate blind drop or landing. On the coast, radar and sound detection networks make the use of a trawler, MTB, or surfaced submarine dangerous not only for the agent but for his transporters. The hulk of a surfaced submarine makes a substantial radar return. In-shore surfacing on a hostile coast, moreover, faces the hazards of mine fields, nets, and chance encounters with naval or commercial small craft.

Buoyant Ascent

One technique which circumvents some of these difficulties is that of buoyant ascent from a *submerged* submarine, wherein the agent makes his exit from the submarine's escape chamber without any kind of breathing apparatus and is carried to the surface at a rate of 375 feet per minute by a "Mae West" inflatable life jacket. This method is conditioned by the contraction of gases under pressure in accordance with Boyle's law—air breathed under pressure at a mere 33 feet down will double in volume at the surface—and the consequent danger of lethal aeroembolism upon ascent. The agent must therefore exhale continuously on his way up.

The procedure is otherwise a simple one. The agent enters the escape chamber, and while its pressure is being equalized by incoming air and water to that of the surrounding water, he breathes the increasingly compressed air. During this time the life jacket is also inflated, either orally or from a

pressure outlet. When the pressure has been equalized, the hatch is opened and he climbs out. He looks to the surface and extends his arm to maintain his posture, and he exhales vigorously during the ascent. Air expansion in the life jacket is taken care of by a bleeder valve which allows the excess pressure to escape into the water. Once on the surface, the jacket can be used to buoy the agent and his gear. Additional equipment—a dinghy, for example—can be carried up on separate floats with connecting lines to facilitate its recovery on the surface.

If it is inadvisable for the agent to show himself on the surface near the coast, swimming or in a dinghy, he can be equipped with the self-contained underwater breathing apparatus, Scuba, to enable him to stay under. For use near the surface there is even a closed-circuit Scuba which makes no exhaust noise and leaves no telltale bubbles (but carries a hazard of oxygen poisoning when used at depths greater than 33 feet).

The exfiltration of an agent can be accomplished by reversing the process. If he is equipped with Scuba, the re-entry into the submarine's escape chamber presents no difficulty. For a free swimmer it might be quite a feat, but Scuba divers from the sub could help him. Emergency contact with the submarine could be made by a Scuba-equipped agent by swimming down and banging on the hull, and without Scuba, in extremity, by dropping very small underwater signal charges. If a number of agents were to be evacuated, it might be best, particularly if they lacked Scuba, for the sub to use its periscope to snag and tow them on a surface line to a point where it could surface or an amphibian could land.

Training for Escape

The buoyant ascent technique has been developed as a means of escape from a disabled submarine.[1] The earliest escape devices were re-breathers of various kinds—the famed U.S. Momsen Lung, the German Draeger, the British BSEA. The United States, in particular, also set great store by the rescue bell, a pressure chamber traveling on a cable that

[1] The fascinating history of submarine escape is comprehensively presented by Commander W. O. Shelford in *Subsunk* (London, 1960).

would lock onto a disabled sub, receive its crew, and transport them to the rescue vessel.

The pattern of World War II's successful submarine escapes, few as they were, favored free ascent, a procedure like buoyant ascent but without a life jacket to speed the surfacing. Its chief disadvantage is the difficulty of correlating the rate of ascent with the rate of exhalation. Too much exhalation could result in drowning, too little in aeroembolism. The correlating maxim "No faster than your smallest bubble" cannot always be followed under stress or in murky water. A free swimmer at depth might also not head straight for the surface.

In 1956, therefore, buoyant ascent became the standard submarine escape method of the United States Navy. Recruits are trained (at New London) and personnel requalified (at New London or Pearl Harbor) by practical exercises in a 118-foot escape tower. Before being put through these runs in the tank, they are tested in a pressure chamber to make sure that they can adjust to the equivalent of 118 feet of depth (50 pounds per square inch, as opposed to 14.7 at sea level). Then there are several hours of class-room and mock-up work before the trainees are taken to the top of the tank, where they begin with shallow ascents to practice the technique.

Finally they are tested in ascents from the 50-foot depth. With an instructor, about ten of them enter an "escape" chamber at that depth. The instructor equalizes the pressure with that in the tank by flooding and admitting air, and the occupants "equalize" as the pressure builds up. Then the hatch swings open, and each trainee in turn fills his life jacket, breathes deeply, and steps out into the tank. Scuba divers watch his bubble stream to determine—as a safety measure and for purposes of evaluation—whether he is exhaling properly. Two successful runs are required for qualification.[2]

[2] A new device for buoyant ascent from greater depths has been developed and tested by Lt. Harris Steinke and his staff at the escape tower. It features a hood attached to the top of the life jacket which captures air vented from the jacket under decreasing pressure so that the escapee can breathe during a long ascent. The Steinke hood has been tested in trial runs from a bottomed submarine at 318 feet off the Dry Tortugas.

The psychological assurance and real value gained from mastery of the buoyant ascent technique are out of all proportion to the one and a half days spent in training for submarine escape, and it should be an equally good bargain in its promising applications to clandestine operations.